COVID-19 and Wichita State University

Wichita State will follow federal, state, and county public health recommendations and mandates related to university operations. The COVID-19 pandemic is a complex, challenging, and fluid situation, which continues to evolve rapidly. Students consistently should review https://www.wichita.edu/about/COVID-19/index.php for the Wichita State COVID-19 Response for information throughout the semester.

CS 898AI, Alternative Computing Paradigms, Spring, 2021

(ECE 876: Computer Systems in Data Analytics)

- Instructor: Abu Asaduzzaman
- Department: Electrical Engineering and Computer Science (EECS)
- Office Location: 253 Jabara Hall (JB) building
- Telephone: +1-316-978-5261
- Email: Abu.Asaduzzaman@wichita.edu

- Preferred Method of Contact: Zoom/phone during student/office hours or via email
- Student/Office Hours: Tuesday and Thursday 3:20–3:50PM & 5:30–6:15PM
- Classroom, Day/Time: HYB, Tuesday and Thursday 2:00–3:15 PM
- Prerequisites: CS 697AM/694 or CS 794, or permission from the instructor
- Teaching Assistant (TA): TBD
- TA Contact: Email – <tbd@shockers.wichita.edu>

How to use this syllabus

This syllabus provides you with information specific to this course, and it also provides information about important university policies. This document should be viewed as a course overview; it is not a contract and is subject to change as the semester evolves. Any changes should be shared via lecture and/or Blackboard.

University Policies and Procedures

The Wichita State University Policies and Procedures Manual can be found at: https://www.wichita.edu/about/policy/.

Academic Integrity

Students at Wichita State University are expected to uphold high academic standards. WSU will not tolerate a lack of academic integrity. Students are responsible for

knowing and following the Student Code of Conduct (see https://www.wichita.edu/about/policy/ch_08/ch8_05.php) and the Student Academic Honesty policy (see https://www.wichita.edu/about/policy/ch_02/ch2_17.php). When the faculty member determines sanctions are warranted for violations of academic integrity, regardless of severity, the faculty member must report the infraction to the Office of Student Conduct and Community Standards. If you need more information about the process or wish to appeal a decision, please visit https://www.wichita.edu/about/student_conduct/AcademicDishonesty.php.

All homework (HW) assignments in this course are individual assignments (unless otherwise stated). Students can discuss with others, but they should not write the solution together; one's submission (wording/coding) should be substantially different from others' submissions. "Collaboration is good, cheating is not!" There will be severe consequences for academic dishonesty. Cheating (such as copying word-for-word from other sources) in any test will automatically result in an F grade for the course; this applies to all the parties involved (including the ones who help/show).

Course Description

Introduces modern computer systems with an emphasis on big data computations and methodologies (such as parallelism and machine learning) necessary for data-driven decision-making. Discusses the future of computing systems and alternative computing technologies. Special attention is given to the following scholarly team activities: technical reading, writing, and presentation.

Definition of a Credit Hour

Success in this 3 credit-hour course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction and preparation/studying or course related activities (such as tests and projects) for a total of 135 hours. [Here, one unit of credit means one credit-hour.]

Measurable Student Learning Outcomes

After passing this course, students will be able to:

- an ability to identify and solve problems with computer systems for data analysis by applying principles of engineering, science, and mathematics
- an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use computational judgment to draw conclusions
- an ability to acquire and apply new knowledge on computer technologies and methodologies as needed, using appropriate learning strategies

Required Texts/Readings Textbook

Please talk to the instructor before buying books for this course.

"COMPUTER ARCHITECTURE: A Quantitative Approach," John L. Hennessy and David A. Patterson, Morgan Kaufmann, 6th edition, 2017.

Reference Book: "Introduction to High Performance Computing for Scientists and Engineers," Georg Hager and Gerhard Wellein, CRC Press, 1st edition, 2010.

Other Readings

Handouts on computer systems, data analytics, machine learning, and related research articles/presentations will be made available via WSU Blackboard.

Handouts on technical reading, writing, and presentation will be made available via WSU Blackboard.

Handouts on "The Future of COMPUTING PERFORMANCE: Game Over or Next Level?" will be made available via WSU Blackboard.

Other Equipment/Materials

Students may be provided accounts to the BeoShock High Performance Computing (HPC) Cluster at WSU and supports so that they can perform parallel programming for homework assignments and/or projects. More information will be made available in class as/if needed.

Class Protocol

There are points on classroom performance. It is expected that students arrive to the assigned room before class starts. Students are always encouraged to ask questions, especially if they find ambiguity in assignments and materials covered.

Contact Policy

Use zoom/telephone during student/office hours. Email communication is also preferred. Feel free to email me any questions or concerns following these guidelines:

- **Always** email me from your WSU email address. Email sent from personal email servers like Gmail, Yahoo, etc., have a tendency to end up in my spam folder, and I never see them. You may also email me through Blackboard via the Email My Instructor tab. I also offer a Discussion Forum on Blackboard which allows common questions to be seen and responded to publicly.
- Always use the course name in the subject line of the email.
- Remember to sign your name.
- If you have a problem with accessing or uploading assignments, you should let me know as soon as possible before the assignment is due. You will also have to accompany this notification with the file in question, so I can verify that it is completed by the due date/time.

- You **should NOT** contact me for tech support.
    - Any technical problems involving your computer, or issues regarding file uploading or sharing, should go through the OneStop. You can contact them at 316-978-3909. You can also fill out a request for help form at their website: https://wichita.edusupportcenter.com/sims/helpcenter/common/layout/SelfHelpHome.seam?inst_name=wichita

Response Time

To Email and Discussion Forum Questions:

As soon as possible within 24 hours. If you do not receive reply to your email within 24 hours, please re-send me the email, probably the email did not arrive to my Inbox.

Feedback on Assignments:

As soon as possible after the due date including the late submission date/time. Answer key will be discussed in lecture sessions and/or shared via Blackboard.

Grading Scale

WSU uses a +/- grading scale for final grades and to calculate grade point averages. In this class, grades are assigned according to the following chart. (Other classes might assign grades differently: Be sure to understand the different grading scales in all of your classes.)

Points/Percentage	Letter Grade	Grade Points	Interpretation
93 and up	A	4.00	A range denotes excellent performance
90 – less than 93	A-	3.70	
87 – less than 90	B+	3.30	
83 – less than 87	B	3.00	B range denotes good performance
80 – less than 83	B-	2.70	
77 – less than 80	C+	2.30	
73 – less than 76	C	2.00	C range denotes satisfactory performance

Points/Percentage	Letter Grade	Grade Points	Interpretation
70 – less than 73	C-	1.70	
67 – less than 70	D+	1.30	
63 – less than 67	D	1.00	D range denotes unsatisfactory performance
60 – less than 63	D-	0.70	
0 – less than 60	F	0.00	

Assignments

List of grading assignments/components and values toward final grades are shown below. Homework assignments and their due dates will be announced in class and/or made available via Blackboard. Similarly, the due dates for Quiz, Exam, and Project will be announced in class and/or made available via Blackboard. Assignments and their points may be changed if required.

Grading Assignments/Components	Value
Class/Lecture Performance (random check)	4%
Homework (four of five, take home)	16%
Quiz (two of three, 30-minute, class-time)	14%
Exam (cumulative, TBD, 65-minute, class-time)	33%
Project (Proposal, Presentation, and Report)	33% [(5+5) + 8 + 15]

(Proposal: defense and write-up; Presentation: oral, 15-min; Report: 15+ pages)

Extra Credit

Extra credits are possible as/if needed. Depending on class performance after Week 10, if required, extra credit assignments and their due dates will be determined.

Late Assignments

For homework assignments, late submissions will not be accepted after five days from the original due date/time. Up to 50% points may be subtracted for any late submission. Exceptions include documented emergency situations and prior consents.

Missed Tests

Makeup for missed tests (Quiz, Exam, and Project) will be given only when there is a genuine reason, with clear proof. It is students' responsibility to provide the proof; if the reason for missing a test is illness, a doctor's note will be required. Students should contact the instructor before any makeup test.

Teaching Assistants

Grading TA:

TBD <tbd@shockers.wichita.edu>

Office Hours/Room: TBD

The Grading TA is not allowed to solve problems. The TA should grade test papers and provide feedback to students for any missing points. If students have any questions regarding assignments, they should immediately contact the course instructor.

Syllabus Policies and Student Resources available at www.wichita.edu/syllabuspolicies

Information on:

- Important Academic Dates
- Academic Integrity
- Definition of a credit hour
- Video and Audio recording
- Shocker Alert System
- Intellectual Property
- CARE Team
- Counseling and Prevention Services
- Student Health Services
- Heskett Center and Campus Recreation
- Inclusive Excellence
- First Generation Students
- Names and Pronouns
- Disability Services
- Title IX
- Concealed Carry Policy

Laboratory Information

Some assignments may require parallel programming resources/facilities available in the BeoShock HPC Cluster at WSU. In order to access BeoShock, students should have their Laptop/PC loaded with Secure Shell (SSH) and Telnet client software such as PuTTY. Username/password to access the CUDA servers (in the CAPPLab) should be provided, if/as needed.

The instructor's research laboratory is located in room 256 Jabara Hall and available online at https://www.wichita.edu/academics/engineering/eecs/faculty/Abu/CAPPLab.php. CAPPLab is an NVIDIA GPU Research Center (2015-2017). CAPPLab is used for research in advanced computer architecture, high performance computing systems, and related fields. It is also used for teaching GPU-assisted parallel programming and microprocessor-based system design.

Tentative Brief List of Topics to Cover

Introduction: What/Why Advanced Computer Systems?

Modern Computer Systems

- Processors, Parallelism (ILP, PLP, DLP, TLP, etc.)
- Cache Memory Hierarchy
- Performance and Power

Course Project

- Technical Reading
- Technical Writing
- Technical Presentation
- Teamwork: Proposal (with literature review), Report, and Presentation

Computational Data Analytics

- Parallel/Distributed Systems: Computations for Big Data
- Computers for Article Intelligence (AI) and Machine Learning (ML)
- Computers for Calculated Decision-Making

Future of Computing

- Advanced Computing Infrastructure to Support Science and Engineering
- The Future of COMPUTING PERFORMANCE

Selected Research Articles

- Performance and/or Power Evaluation

Tentative Schedule for 15-week class

Zoom Meeting Days / Times: Tue & Thu / 2:00-3:15 PM (Feb. 01 – May 13)

In-Person Meeting: To be determined and shared via lecture/Blackboard

Week	Date	Note	Important topics/readings, assignments, due dates, and reminders are listed here so that you can organize your time and academic work.
1	02/02 02/04		CS 898AI: Course syllabus; Why Computers? K-probe; HW-1 Assign; Project: Groups, Components, Grading;
2	02/09 02/11	HW	Conventional/Modern Computer Systems; HW-1 (due); Project: Topics; Proposal due on Week 6;
3	02/16 02/18	HW	Technical Reading, Writing, and Presenting; HW-2 (due); Quiz-1 discussion;
4	02/23 02/25	Quiz	Parallelism for Improving Computing Performance; Quiz-1 (30-min, 30 pts, Closed book);
5	03/02 03/04	Update	Project: Proposal – components, presentation; Proposal: Defense (10 minutes per group);
6	03/09 03/11	Project	Cache-Memory for Performance/Power; Project: Proposal (due)
7	03/16 03/18	HW	Computation Vs Communication; HW-3 (due);
8	03/23 03/25	HW	Multicore/Many-Core and Parallel/Distributed Systems; HW-4 (due); Quiz-2 discussion;
9	03/30		Data Analysis: Applications of Machine Learning;

Week	Date	Note	Important topics/readings, assignments, due dates, and reminders are listed here so that you can organize your time and academic work.
	04/01	Quiz	Quiz-2 (30-min, 30 pts, Closed book);
10	04/06 04/08	Update	Data Analysis: Calculated Decision-Making; Project: Presentation, Report, Templates;
11	04/13 04/15	HW	Selected Research Articles; Quiz-3 discussion; HW-5 (due); Project: Presentation, Report, Templates;
12	04/20 04/22	Quiz-3	Selected: Adv. Comp. Infrastructure to Support Sci. & Eng.; Quiz-3 (30-min, 30 pts, Closed book); Exam discussion;
13	04/27 04/29	Exam	Selected: The Future of Computing Performance; Exam (cumulative, 65 minutes, 65 points, Closed book)
14	05/04 05/06	Project	Project Presentation: Team-work, Presentation slides; Final Report: Team-work, via Blackboard on Study day;
~~15~~	~~Finals~~	~~N/A~~	~~None~~

[_v3) Updated on Jan. 21, 2021; added date information; DRZ]

[_v2) Updated on Jan. 6, 2021; updated topics; DRZ]

[_v1) Updated on December 20, 2020; from fall 2019; DRZ]